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SPEC. NUMBER

PRODUCT GROUP
TFT MODULE

Rev. O

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2013.02.05PAGE
1 OF 29**TITLE : HR215WU1-200****Product Specification****Rev. O****HEFEI BOE OPTOELECTRONICS TECHNOLOGY**



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REVISION HISTORY

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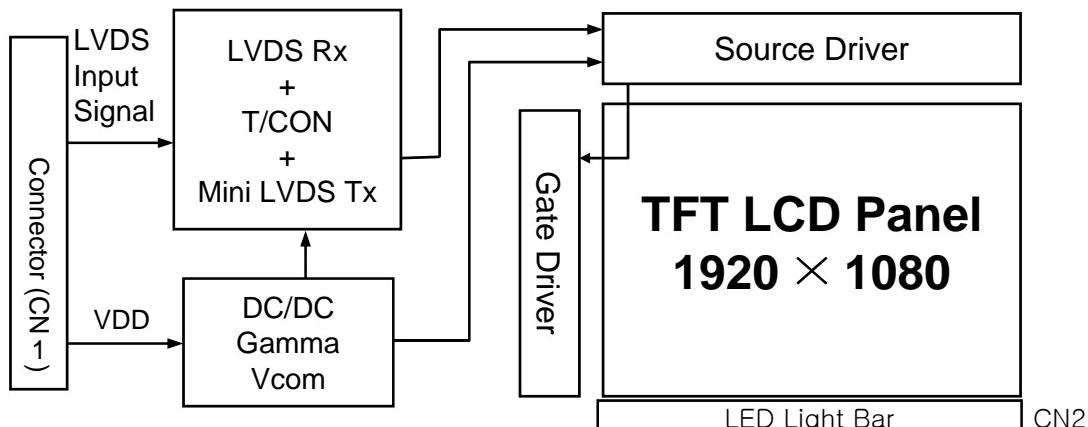
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1.0 GENERAL DESCRIPTION

1.1 Introduction

HR215WU1-200 is a color active matrix TFT LCD module using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 21.5 inch diagonally measured active area with FHD resolutions (1920 horizontal by 1080 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.7M colors. The TFT-LCD panel used for this module is adapted for a low reflection and higher color type.



1.2 Features

- LVDS Interface with 2 pixel / clock
- High-speed response
- 6-bit (Hi-FRC) color depth, display 16. 7M colors
- Incorporated edge type back-light (One Light Bar)
- High luminance and contrast ratio, low reflection and wide viewing angle
- DE (Data Enable) only
- RoHS /TCO 5.0 ,ES5.0 Compliant

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1.3 Application

- Desktop Type of PC & Workstation Use
- Slim-Size Display for Stand-alone Monitor
- Display Terminals for Control System
- Monitors for Process Controller

1.4 General Specification

The followings are general specifications at the model HR215WU1-200.

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	476.64(H) × 268.11 (V)	mm	
Number of pixels	1920(H) × 1080(V)	pixels	
Pixel pitch	0.24825(H) × 0.24825(V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	16.7M	colors	
Display mode	Normally Black		
Dimensional outline	495.6(H) × 292.2(V) × 10.7(D) typ.	mm	
Weight	2150 (typ.)	g	
Surface Treatment	Anti-glare, 3H		
Back-light	Lower side 1-LED Light bar Type		

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2.0 ABSOLUTE MAXIMUM RATINGS

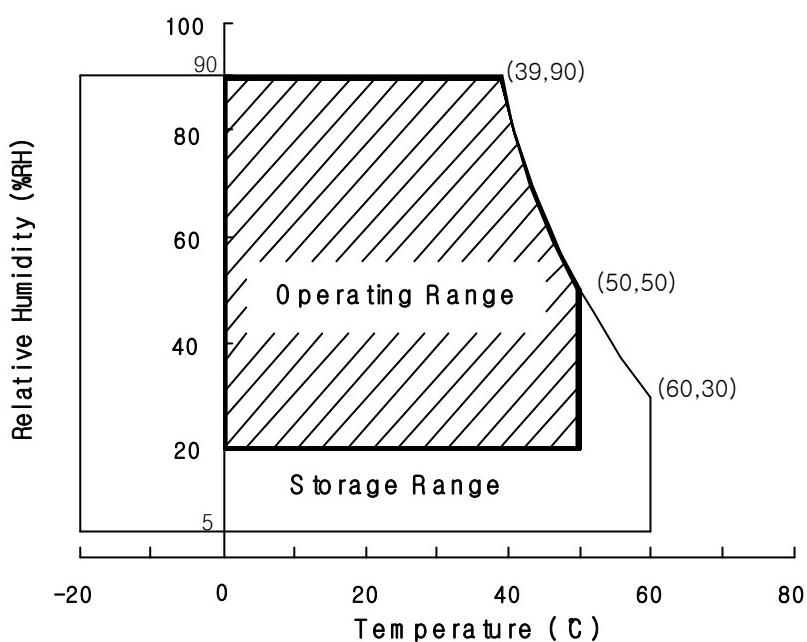
The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Absolute Maximum Ratings> [VSS=GND=0V]

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	-0.5	5.5	V	$T_a = 25^{\circ}\text{C}$
Logic Supply Voltage	V_{IN}	$V_{SS}-0.3$	$V_{DD}+0.3$	V	
Operating Temperature	T_{OP}	0	+50	$^{\circ}\text{C}$	1)
Storage Temperature	T_{ST}	-20	+60	$^{\circ}\text{C}$	1)

Note : 1) Temperature and relative humidity range are shown in the figure below.

Wet bulb temperature should be 39 $^{\circ}\text{C}$ max. and no condensation of water.



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3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

< Table 3. Electrical specifications >

[Ta = 25 ± 2 °C]

Parameter	Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V _{DD}	4.5	5.0	V	Note 1
Power Supply Current	I _{DD}	-	800	mA	
In-Rush Current	I _{RUSH}	-	-	A	Note 2
Permissible Input Ripple Voltage	V _{RF}	-	-	mV	V _{DD} = 5.0V
High Level Differential Input Threshold Voltage	V _{IH}	-	-	+100	mV
Low Level Differential Input Threshold Voltage	V _{IL}	-100	-	-	mV
Differential input voltage	V _{ID}	200	-	600	mV
Differential input common mode voltage	V _{Cm}	1.0	1.2	1.5	V _{IH} =100mV, V _{IL} =-100mV
LED Voltage	V _L	-	3.2	3.5	V
LED Channel Voltage	V _L	39.65	41.6	45	
LED Channel Current	I _L	-	120	130	mA
LED Lifetime		30,000	-	-	Hrs I _L =120 mA
Power Consumption	P _D	-	4.9	6.25	W
	P _{BL}	-	19.97	21	W I _L =120 mA, Note 4
	P _{total}	-	24.87	27.25	W

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.

The current draw and power consumption specified is for VDD=5.0V, Frame rate=75Hz. Test Pattern of power supply current

- a) Typ : Color Bar pattern
- b) Max : Skip Sub Pixel Pattern



- 2. Duration of rush current is about 2 ms and rising time of VDD is 520 μs ± 20 %
- 3. The lamp frequency should be selected as different as possible from the horizontal synchronous frequency and its harmonics to avoid interference, which may cause line flow on the display
- 4. Calculated value for reference (V_L × I_L) × 4(channel) excluding driver loss. (LED Light bar: 13S4P)

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4.0 OPTICAL SPECIFICATION

4.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = $25 \pm 2^\circ\text{C}$) with the equipment of Luminance meter system (Goniometer system and TOPCONE BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0° . We refer to $\theta_{\phi=0}$ ($=\theta_3$) as the 3 o'clock direction (the "right"), $\theta_{\phi=90}$ ($=\theta_{12}$) as the 12 o'clock direction ("upward"), $\theta_{\phi=180}$ ($=\theta_9$) as the 9 o'clock direction ("left") and $\theta_{\phi=270}$ ($=\theta_6$) as the 6 o'clock direction ("bottom"). While scanning θ and/or ϕ , the center of the measuring spot on the Display surface shall stay fixed. The measurement shall be executed after 30 minutes warm-up period. VDD shall be 5.0V +/-10% at 25°C . Optimum viewing angle direction is 6 'clock.

4.2 Optical Specifications

[VDD = 5.0V, Frame rate = 60Hz, Clock = 78MHz, $I_{BL} = 120\text{mA}$, $T_a = 25 \pm 2^\circ\text{C}$]

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	
Viewing Angle range	Horizontal	Θ_3	CR > 10	-	89	-	Deg.	Note 1	
		Θ_9		-	89	-	Deg.		
	Vertical	Θ_{12}		-	89	-	Deg.		
		Θ_6		-	89	-	Deg.		
Viewing Angle range	Horizontal	Θ_3	CR > 5	-	89	-	Deg.		
		Θ_9		-	89	-	Deg.		
	Vertical	Θ_{12}		-	89	-	Deg.		
		Θ_6		-	89	-	Deg.		
Luminance Contrast ratio		CR	$\Theta = 0^\circ$ (Center) Normal Viewing Angle	700	1000			Note 2	
Luminance of White		Y_w		200	250		cd/m ²	Note 3	
White luminance uniformity		ΔY		75	80		%	Note 4	
Reproduction of color	White	W_x		0.283	0.313	0.343		Note 5	
		W_y		0.299	0.329	0.359			
	Red	R_x		0.617	0.647	0.677			
		R_y		0.309	0.339	0.369			
	Green	G_x		0.277	0.307	0.337			
		G_y		0.603	0.633	0.663			
	Blue	B_x		0.116	0.146	0.176			
		B_y		0.026	0.056	0.086			
Response Time	Rising+Falling	T_{r+f}			14	21	ms	Note 6	
Cross Talk		CT		-	-	2.0	%	Note 7	

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Note :

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface.
2. Contrast measurements shall be made at viewing angle of $\theta = 0^\circ$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. (See FIGURE 1 shown in Appendix) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Center Luminance of white is defined as the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display.
4. The White luminance uniformity on LCD surface is then expressed as :

$$\Delta Y = (\text{Minimum Luminance of 9points} / \text{Maximum Luminance of 9points}) * 100$$
(See FIGURE 2 shown in Appendix).
5. The color chromaticity coordinates specified in Table 4. shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.
6. The electro-optical response time measurements shall be made as FIGURE 3 shown in Appendix by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Td, and 90% to 10% is Tr.
7. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (Y_A) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (Y_B) of that same area when any adjacent area is driven dark. (See FIGURE 4 shown in Appendix).

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5.0 INTERFACE CONNECTION.

5.1 Electrical Interface Connection

- CN1 Module Side Connector : UJU IS100-L300-C23 or Equivalent
User Side Connector : JAE FI-X30H or Equivalent

Pin No	Symbol	Function	Remark
1	RXO0-	Negative Transmission data of Pixel 0 (ODD)	
2	RXO0+	Positive Transmission data of Pixel 0 (ODD)	
3	RXO1-	Negative Transmission data of Pixel 1 (ODD)	
4	RXO1+	Positive Transmission data of Pixel 1 (ODD)	
5	RXO2-	Negative Transmission data of Pixel 2 (ODD)	
6	RXO2+	Positive Transmission data of Pixel 2 (ODD)	
7	GND	Power Ground	
8	RXOC-	Negative Transmission Clock (ODD)	
9	RXOC+	Positive Transmission Clock (ODD)	
10	RXO3-	Negative Transmission data of Pixel 3 (ODD)	
11	RXO3+	Positive Transmission data of Pixel 3 (ODD)	
12	RXE0-	Negative Transmission data of Pixel 0 (EVEN)	
13	RXE0+	Positive Transmission data of Pixel 0 (EVEN)	
14	GND	Power Ground	
15	RXE1-	Negative Transmission data of Pixel 1 (EVEN)	
16	RXE1+	Positive Transmission data of Pixel 1 (EVEN)	
17	GND	Power Ground	
18	RXE2-	Negative Transmission data of Pixel 2 (EVEN)	
19	RXE2+	Positive Transmission data of Pixel 2 (EVEN)	
20	RXEC-	Negative Transmission Clock (EVEN)	
21	RXEC+	Positive Transmission Clock (EVEN)	
22	RXE3-	Negative Transmission data of Pixel 3 (EVEN)	
23	RXE3+	Positive Transmission data of Pixel 3 (EVEN)	
24	GND	Power Ground	Note1
25	NC	Not connection, this pin should be open	
26	NC	Not connection, this pin should be open	
27	NC	Not connection	
28	VDD1	Power Supply: +5V	
29	VDD2		
30	VDD3		

Note 1 : This pin should be connected with GND

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5.2 LVDS Interface (Tx; THC63LVDF83A or Equivalent)

5.2.1 ODD LVDS Interface

	Input Signal	Transmitter		Interface		HR215WU1-200 (CN11)	Remark
		Pin No.	Pin No.	System (Tx)	TFT-LCD (Rx)		
O D D L V D S	OR0	51	48	OUT0- OUT0+	RXO0- RXO0+	1 2	
	OR1	52					
	OR2	54					
	OR3	55					
	OR4	56					
	OR5	3					
	OG0	4	46	OUT1- OUT1+	RXO1- RXO1+	3 4	
	OG1	6					
	OG2	7					
	OG3	11					
	OG4	12					
	OG5	14					
	OB0	15	42	OUT2- OUT2+	RXO2- RXO2+	5 6	
	OB1	19					
	OB2	20					
	OB3	22					
	OB4	23					
	OB5	24					
	Hsync	27	38	OUT3- OUT3+	RXO3- RXO3+	10 11	
	Vsync	28					
	DE	30					
	MCLK	31		CLK OUT- CLK OUT+	RXO CLK- RXO CLK+	8 9	
	OR6	50					
	OR7	2	37				
	OG6	8					
	OG7	10					
	OB6	16					
	OB7	18					
	RSVD	25					

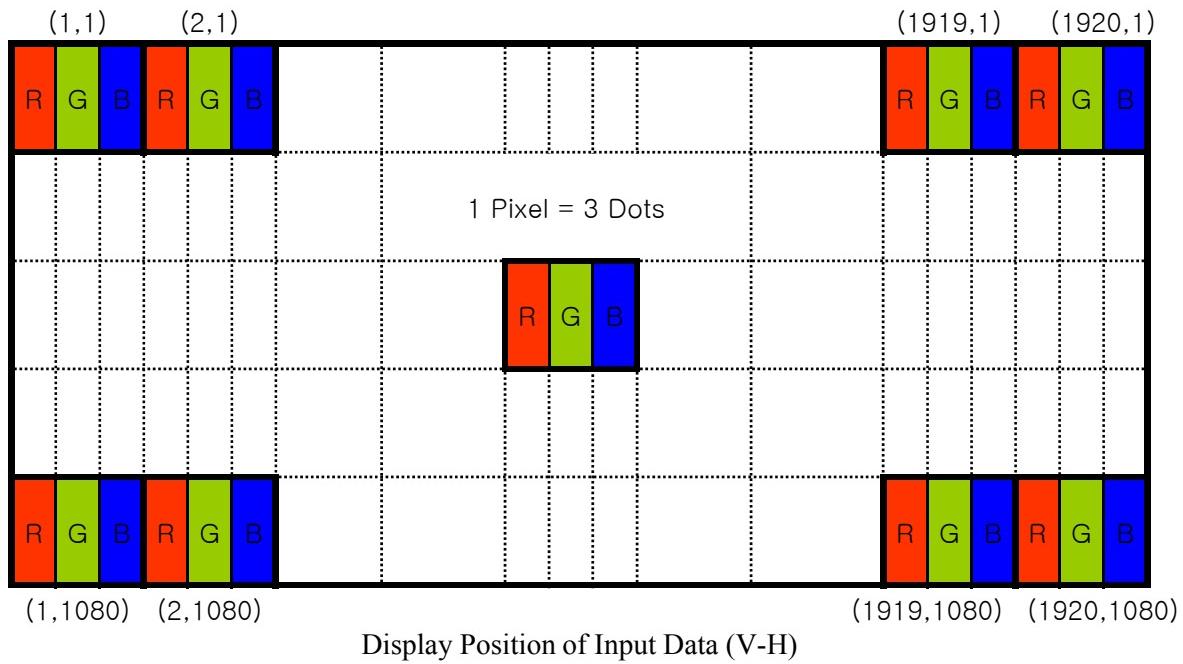
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5.2.2 EVEN LVDS Interface

Input Signal	Transmitter		Interface		HR215WU1-200 (C N11)	Remark
	Pin No.	Pin No.	System (Tx)	TFT-LCD (Rx)		
EVEN LVDS	ER0	51	48	OUT0- OUT0+	RXE0- RXE0+	12 13
	ER1	52				
	ER2	54				
	ER3	55				
	ER4	56				
	ER5	3				
	EG0	4				
	EG1	6	46	OUT1- OUT1+	RXE1- RXE1+	15 16
	EG2	7				
	EG3	11				
	EG4	12				
	EG5	14				
	EB0	15	42	OUT2- OUT2+	RXE2- RXE2+	18 19
	EB1	19				
	EB2	20				
	EB3	22	38	OUT3- OUT3+	RXE3- RXE3+	22 23
	EB4	23				
	EB5	24				
	Hsync	27				
	Vsync	28	37			
	DE	30				
	MCLK	31				
			40	CLK OUT- CLK OUT+	RXE CLK- RXE CLK+	20 21
	ER6	50	38			
	ER7	2				
	EG6	8				
	EG7	10				
	EB6	16				
	EB7	18				
	RSVD	25				

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5.3 Data Input Format



5.4 Back-light Interface Connection

●CN 2

LED LightBar Connector :CI1406M1HRL-NH or equivalent

Pin	Function
1	Channel 1 Current Feedback
2	Channel 2 Current Feedback
3	LED Power Supply
4	LED Power Supply
5	Channel3 Current Feedback
6	Channel4 Current Feedback

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6.0 SIGNAL TIMING SPECIFICATION

6.1 The HR215WU1-200 is operated by the DE only.

Item		Symbols	Min	Typ	Max	Unit
Clock	Frequency	1/Tc	61.93	74.32	92.90	MHz
	High Time	Tch	-	4/7 Tc	-	
	Low Time	Tcl	-	3/7 Tc	-	
Frame Period		Tv	1091	1125	1149	lines
			50	60	75	Hz
			20	16.67	13.33	ms
Vertical Display Period		Tvd	-	1080	-	lines
H-blank			100	140	240	lines
V-blank			11	45	69	lines
One line Scanning Period		Th	1060	1100	1200	clocks
Horizontal Display Period		Thd	-	960	-	clocks
LVDS Receiver Clock	Input cycle to cycle jitter	Trcl	-100	-	100	ps
	Spresd Spectrum modulation range	Fclkin_m od	Fclkin*-3%	-	Fclkin*+3%	MHz
	Spresd Spectrum modulation frequency	Fssm	-	-	300	KHz

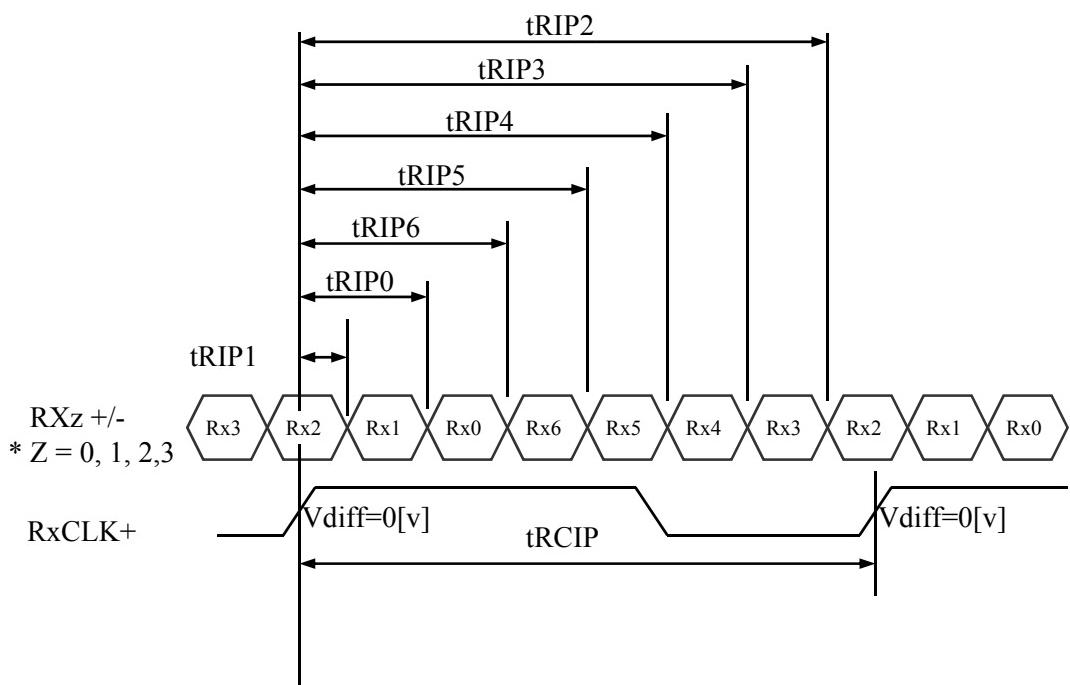
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6.2 LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter is shown in Table 4.

<Table 4. LVDS Rx Interface Timing Specification>

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	10.76	13.46	16.15	nsec	
Input Data 0	tRIP1	-0.4	0.0	+0.4	nsec	
Input Data 1	tRIP0	tRCIP/7-0.4	tRCIP/7	tRCIP/7+0.4	nsec	
Input Data 2	tRIP6	$2 \times tRCIP/7 - 0.4$	$2 \times tRCIP/7$	$2 \times tRCIP/7 + 0.4$	nsec	
Input Data 3	tRIP5	$3 \times tRCIP/7 - 0.4$	$3 \times tRCIP/7$	$3 \times tRCIP/7 + 0.4$	nsec	
Input Data 4	tRIP4	$4 \times tRCIP/7 - 0.4$	$4 \times tRCIP/7$	$4 \times tRCIP/7 + 0.4$	nsec	
Input Data 5	tRIP3	$5 \times tRCIP/7 - 0.4$	$5 \times tRCIP/7$	$5 \times tRCIP/7 + 0.4$	nsec	
Input Data 6	tRIP2	$6 \times tRCIP/7 - 0.4$	$6 \times tRCIP/7$	$6 \times tRCIP/7 + 0.4$	nsec	



$$* V_{diff} = (RXz+) - (RXz-), \dots, (RXCLK+) - (RXCLK-)$$



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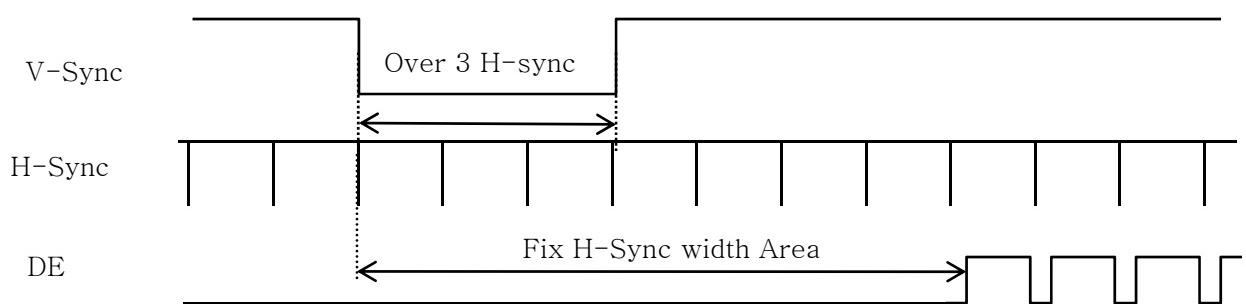
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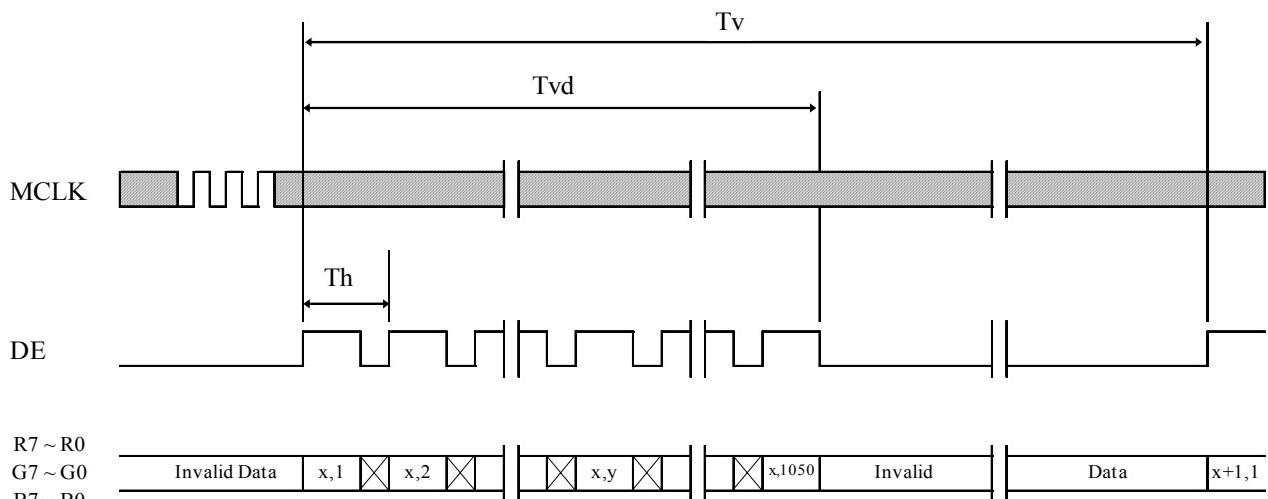
7.0 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

7.1 Sync Timing Waveforms



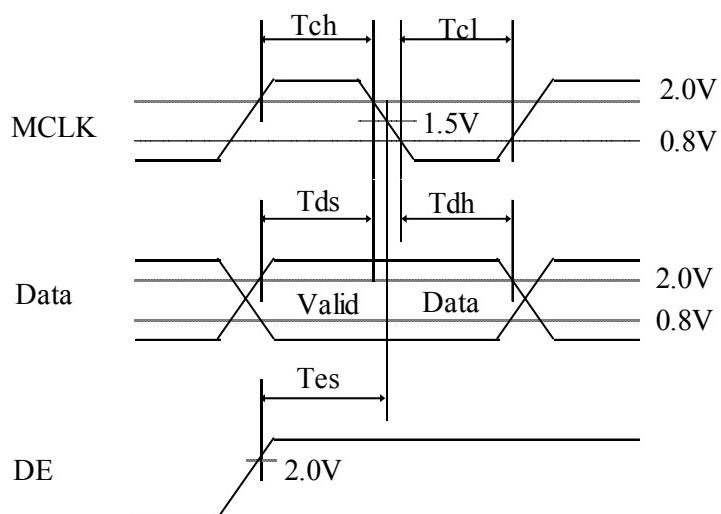
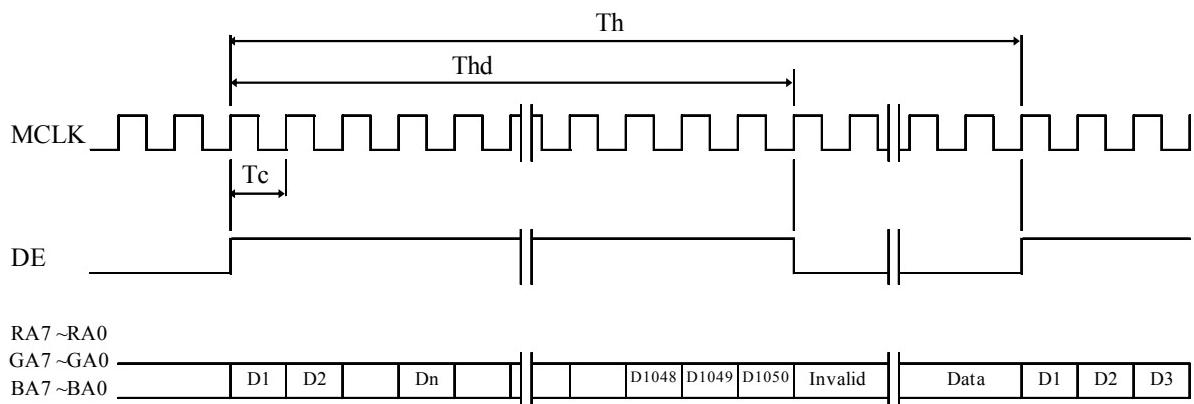
- 1) Need over 3 H-sync during V-Sync Low
- 2) Fix H-Sync width from V-Sync falling edge to first rising edge

7.2 Vertical Timing Waveforms



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7.3 Horizontal Timing Waveforms





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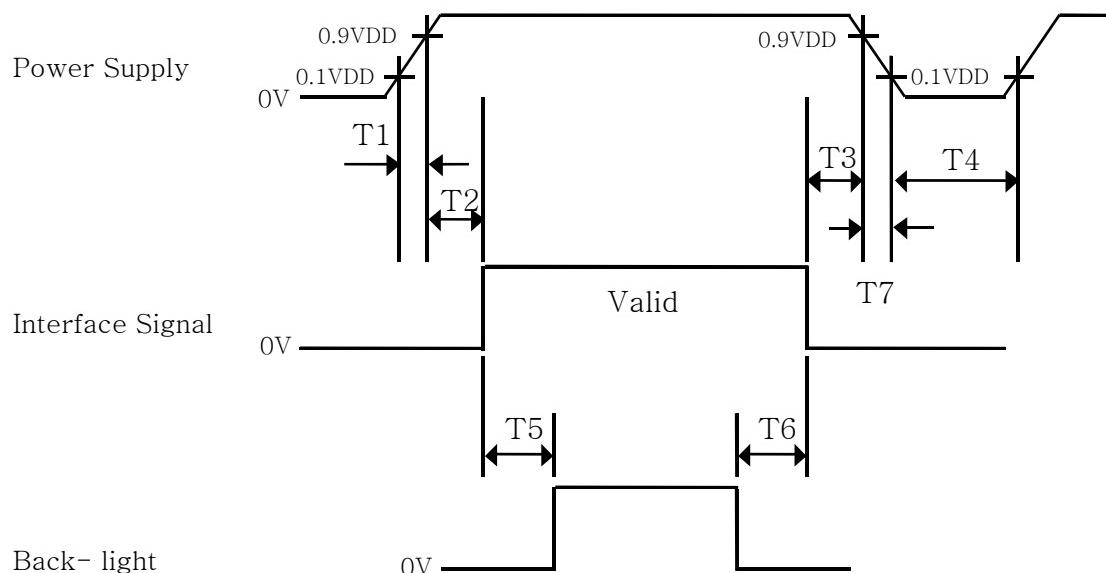
8.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

Color & Gray Scale		RED DATA							GREEN DATA							BLUE DATA								
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale of RED	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	↑							↑							↑								
	▽	↓							↓							↓								
	Brighter	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	▽	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of GREEN	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	△	↑							↑							↑								
	▽	↓							↓							↓								
	Brighter	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	1	0	0	0	0	0
	▽	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale of BLUE	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	△	↑							↑							↑								
	▽	↓							↓							↓								
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Gray Scale of WHITE	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	△	↑							↑							↑								
	▽	↓							↓							↓								
	Brighter	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0
	▽	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

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9.0 POWER SEQUENCE

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below



- $0.5 \text{ ms} \leq T1 \leq 10 \text{ ms}$
- $0 \leq T2 \leq 50 \text{ ms}$
- $0 \leq T3 \leq 50 \text{ ms}$
- $1 \text{ sec} \leq T4$
- $200 \text{ ms} \leq T5$
- $200 \text{ ms} \leq T6$
- $0 \leq T7 \leq 50 \text{ ms}$

Notes:

1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on.
3. Back Light must be turn on after power for logic and interface signal are valid.

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10.0 MECHANICAL CHARACTERISTICS

10.1 Dimensional Requirements

FIGURE 6 (located in Appendix) shows mechanical outlines for the model HR215WU1-200. Other parameters are shown in Table 5.

<Table 5. Dimensional Parameters>

Parameter	Specification	Unit
Dimensional outline	495.6 × 292.2 × 10.7	mm
Weight	2150(typ.)	g
Active area	476.64(H) × 268.11(V)	mm
Pixel pitch	0.24825(H) x 0.24825(V)	mm
Number of pixels	1920(H) × 1080(V) (1 pixel = R + G + B dots)	pixels
Back-light	Lower side 1-LED Light bar Type	

10.2 Mounting

See FIGURE 5. (shown in Appendix)

10.3 Anti-Glare and Polarizer Hardness.

The surface of the LCD has an Anti-glare coating to reduce reflection and a coating to reduce scratching.

10.4 Light Leakage

There shall not be visible light from the back-lighting system around the edges of the screen as seen from a distance 50cm from the screen with an overhead light level of 250lux.

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11.0 RELIABILITY TEST

The Reliability test items and its conditions are shown in below.

<Table 6. Reliability Test Parameters >

No	Test Items	Conditions	
1	High temperature storage test	Ta = 60 °C, 240 hrs	
2	Low temperature storage test	Ta = -20 °C, 240 hrs	
3	High temperature & high humidity operation test	Ta = 50 °C, 80%RH, 240hrs	
4	High temperature operation test	Ta = 50 °C, 240hrs	
5	Low temperature operation test	Ta = 0 °C, 240hrs	
6	Thermal shock	Ta = -20 °C ↔ 60 °C (0.5 hr), 100 cycle	
7	Vibration test (non-operating)	Frequency Gravity / AMP Period	10 ~ 300 Hz, Sweep rate 30 min 1.5 G X, Y, Z 30 min
8	Shock test (non-operating)	Gravity	50G
		Pulse width	11msec, sine wave
		Direction	± X, ± Y, ± Z Once for each
9	Electro-static discharge test (non-operating)	Air Contact	: 150 pF, 330Ω, 15 KV : 150 pF, 330Ω, 8 KV
10	Altitude test	Operating: 0 to 16400ft , 0 to 40°	
		Non Operating: 0 to 40000ft, -20 to 40°	

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12.0 HANDLING & CAUTIONS

(1) Cautions when taking out the module

- Pick the pouch only, when taking out module from a shipping package.

(2) Cautions for handling the module

- As the electrostatic discharges may break the LCD module, handle the LCD module with care. Peel a protection sheet off from the LCD panel surface as slowly as possible.
- As the LCD panel and back - light element are made from fragile glass material, impulse and pressure to the LCD module should be avoided.
- As the surface of the polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.
- Do not pull the interface connector in or out while the LCD module is operating.
- Put the module display side down on a flat horizontal plane.
- Handle connectors and cables with care.

(3) Cautions for the operation

- When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the LCD panel would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.

(4) Cautions for the atmosphere

- Dew drop atmosphere should be avoided.
- Do not store and/or operate the LCD module in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.

(5) Cautions for the module characteristics

- Do not apply fixed pattern data signal to the LCD module at product aging.
- Applying fixed pattern for a long time may cause image sticking.

(6) Other cautions

- Do not disassemble and/or re-assemble LCD module.
- Do not re-adjust variable resistor or switch etc.
- When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

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13.0 PRODUCT SERIAL NUMBER



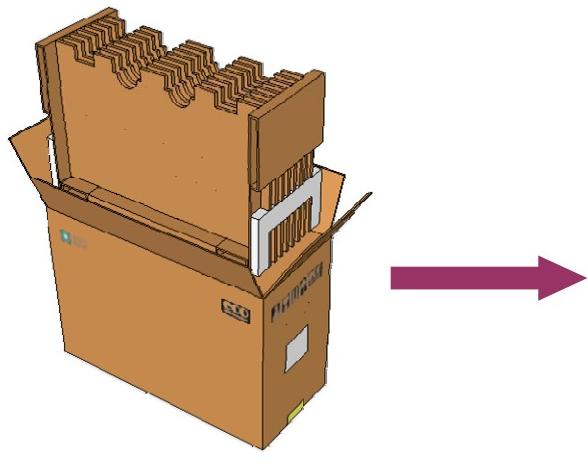
- | | |
|-------------------------------------|-----------------------------------|
| 1. Control Number | 5. Month (1,2,3, ..., 9, X, Y, Z) |
| 2. Rank / Grade | 6. Internal Use |
| 3. Line Classification | 7. Serial Number |
| 4. Year (2001 : 01, 2002 : 02, ...) | |

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14.0 Packing

14.1 Packing Order

Put Paper Pad into the inbox



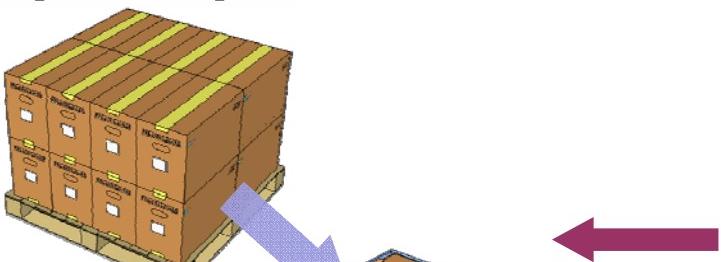
Put module into the paper spacer and modules bundled by PE Bag



2 layers per Pallet, 8 inner boxes per layer

Pallet outer package : Protective film & Paper Corner

112pcs Module per Pallet



Put Cover on the top of the pad and Sealing the box



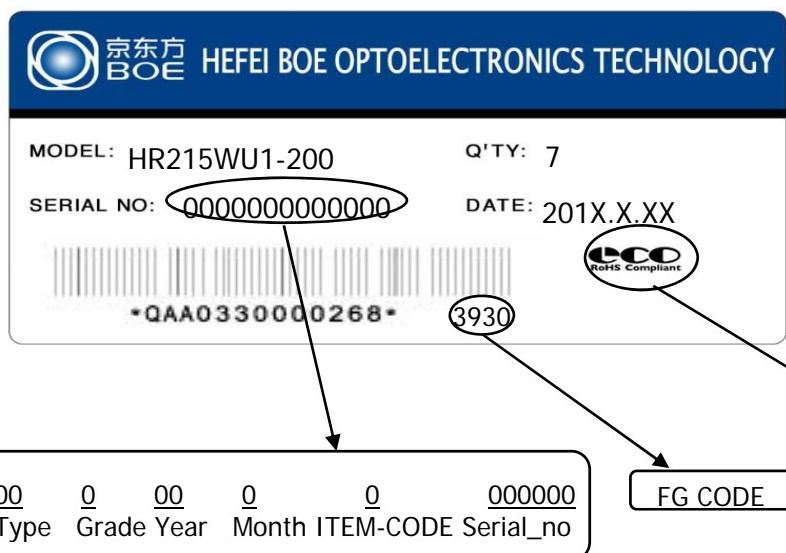
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14.2 Packing Specification and Note

Item	Specification			Remark
	Q'ty	Dimension	Weight (kg)	
Packing Box	7pcs/Box	565(L)mm x 240(W)mm x 370(H)mm	16	-
Pallet	1	1200(L)mm x 1100(W)mm x 130(H)m m	15.90	-
Pallet after Packing	16boxes/ pallet	1200(L)mm x 1100W)mm x 820(H)mm	870	-

14.3 Box label

- Label Size : 108 mm (L) × 56 mm (W)
- Contents
 - Model : HR215WU1-200
 - Q'ty : Module Q'ty in one box
 - Serial No. : Box Serial No. See next page for detail description.
 - Date : Packing Date
 - FG Code : FG Code of Product



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15.0 APPENDIX

Figure 1. Measurement Set Up

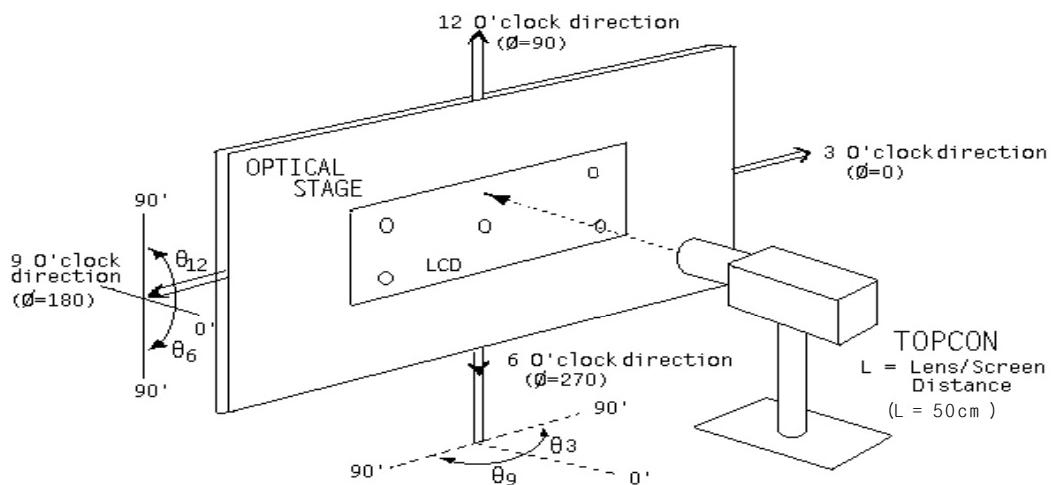
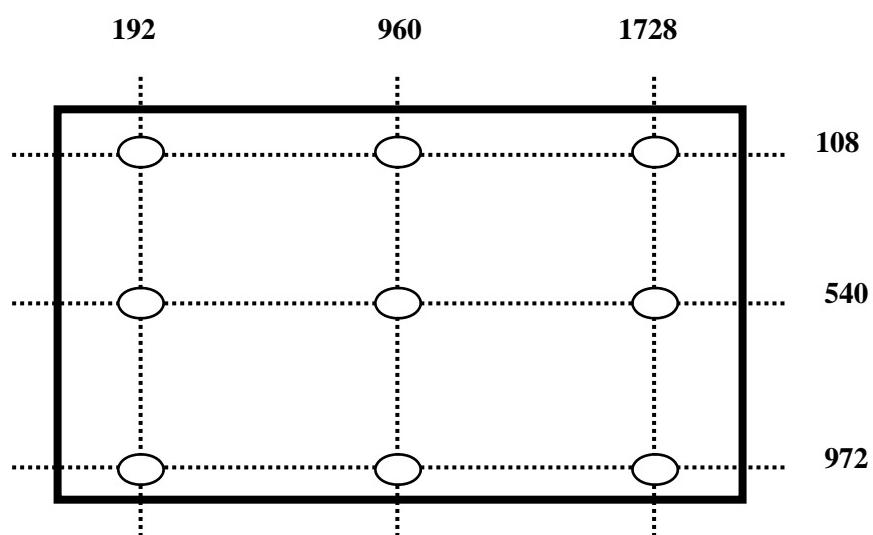


Figure 2. White Luminance and Uniformity Measurement Locations (9 points)



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Figure 3. Response Time Testing

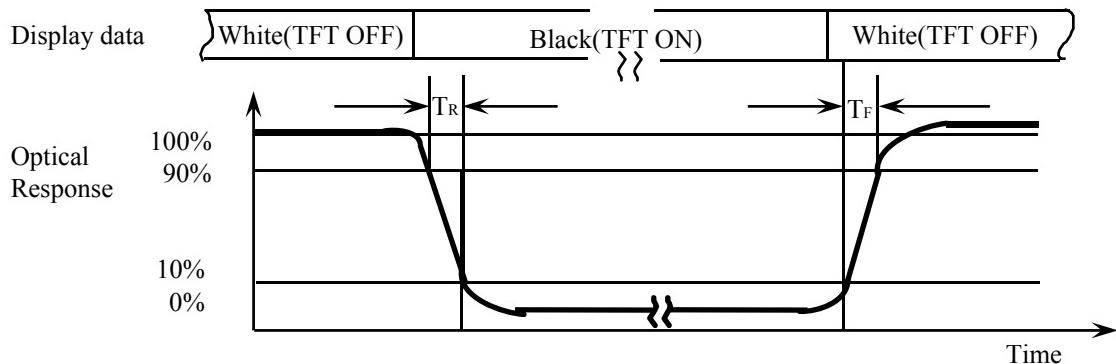
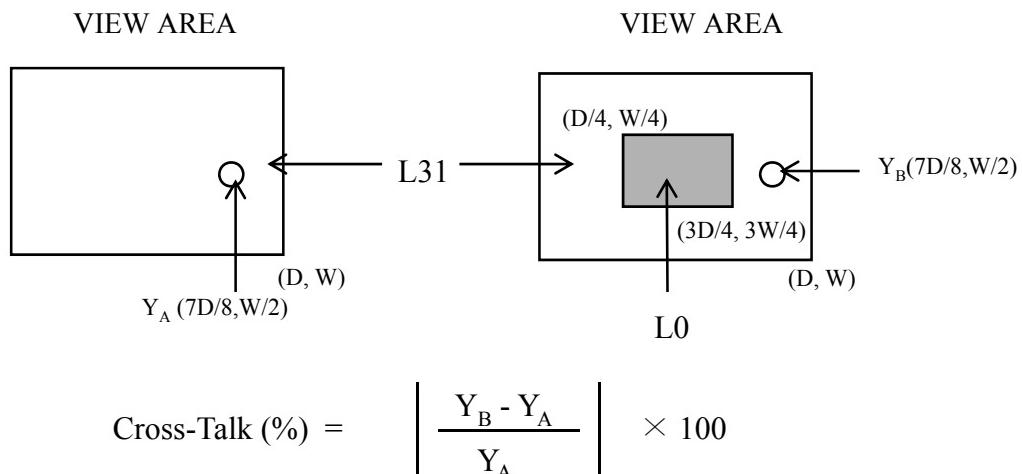


Figure 4. Cross Modulation Test Description



Where: Y_A = Initial luminance of measured area (cd/m^2)
 Y_B = Subsequent luminance of measured area (cd/m^2)
The location measured will be exactly the same in both patterns



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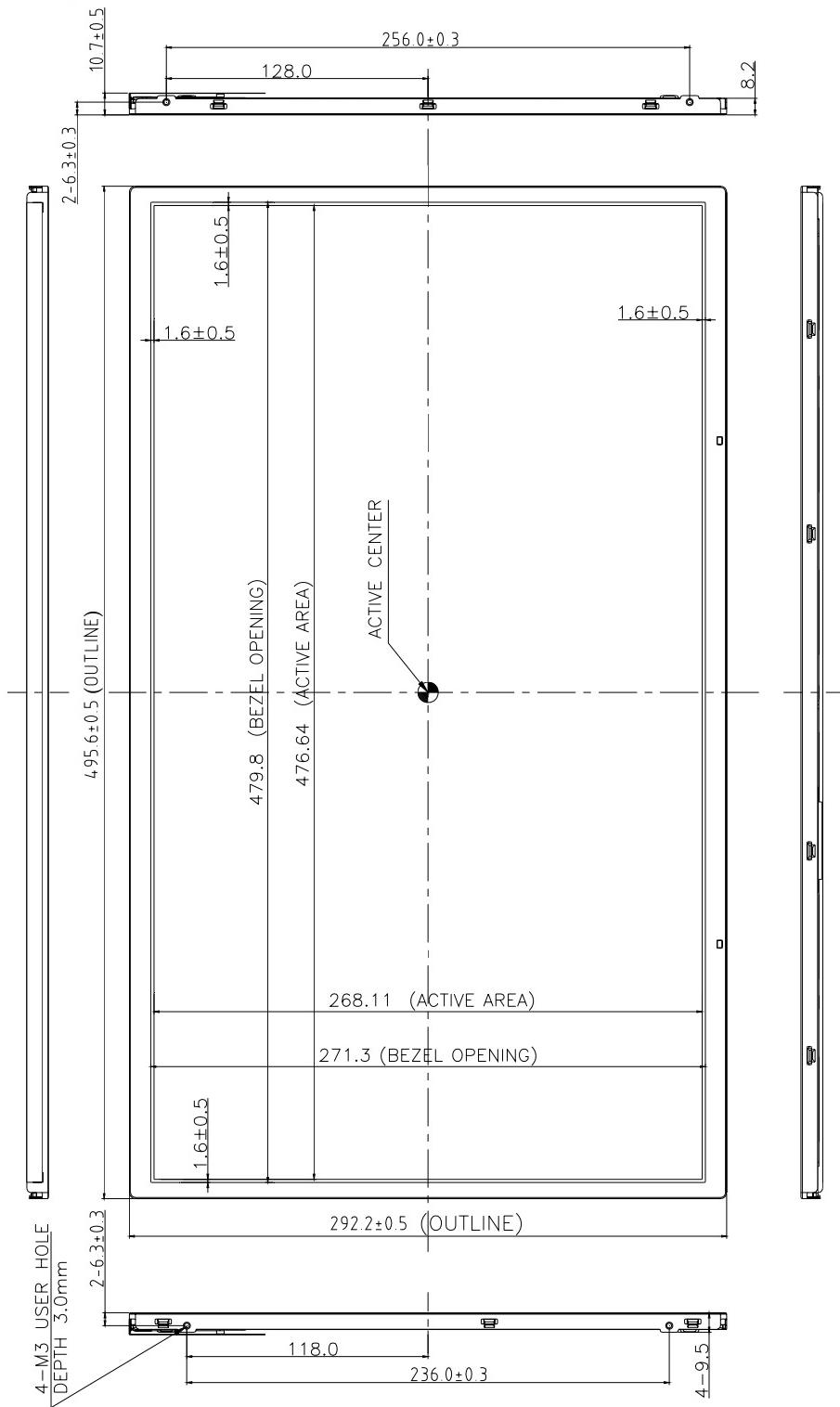
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Figure 5. TFT-LCD Module Outline Dimensions (Front view)





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Figure 6. TFT-LCD Module Outline Dimensions (Rear view)

